

## CHAPTER 3: ALTERNATIVES

Chapter 3 describes the project alternatives, including the preferred alternative and the no build alternative. The analysis of alternatives was documented in the *Interstate 10 Traffic Interchange at Twin Peaks/Linda Vista Alternatives Selection Report*, dated May 3, 2004. Although readers are referred to the *Alternatives Selection Report* for a more thorough discussion, the results of the analyses are summarized here.

### Alternative Corridor Evaluation

A series of analyses were applied to improvement alternatives considered for this project. These analyses began with very simple qualitative criteria and progressed through a series of successively more detailed analyses as the alternatives were refined. The first analysis was to determine if a proposed alternative met the project purpose and need as defined in the previous chapter. If the alternative met the purpose and need, it was advanced for additional study, if it did not, it was eliminated from additional consideration.

Both the 1989 *Marana Master Transportation Plan* and ADOT's 1990 *I-10 Design Concept Study, Ruthrauff Road to the Pima/Pinal County Line* recommended a new I-10 TI between the I-10 interchanges at Cortaro and Avra Valley Roads. This location served the Town of Marana's objective to serve as part of a planned parkway system and achieved ADOT's goals for desirable interchange spacing and for traffic congestion relief at the Cortaro Road TI.

During the Public Open House of October 20, 2003, several individuals suggested that the new interchange with I-10 be constructed north of Twin Peaks Road; therefore, this alternative corridor was considered early in the analysis of alternatives. It was found that the construction of a new TI north of Twin Peaks Road would have two major disadvantages: 1) it would not provide proper interchange spacing along I-10; and, 2) it would not adequately relieve traffic on Cortaro Road and Silverbell Road.

According to AASHTO's *A Policy of Geometric Design of Highways and Streets* (2001) (AASHTO *Green Book*), interchange spacing has a pronounced effect on freeway operations. A general rule of thumb for minimum interchange spacing is 1 mile from on-ramp to off-ramp in urban areas. Placement of an interchange north of Twin Peaks Road would result in less than recommended spacing between the ramps of the new interchange and the Avra Valley Road TI ramps. A grade-separated railroad crossing at the Twin Peaks Road TI location would produce desirable spacing of approximately five miles between grade separated railroad crossings at the Prince Road/La Cholla Road, Orange Grove Road, and Twin Peaks Road TIs.

A TI has been recommended at the approximate location of Twin Peaks Road for many years because of the desirable design characteristics discussed above and because many trips originate and end in Continental Ranch and the surrounding area. If the TI were constructed north of Twin Peaks Road, Continental Ranch residents would be required to drive farther to access the new TI. As a result, the TI would be used less, and congestion

and safety on Cortaro Road and Silverbell Road would not be improved sufficiently. For these reasons, an alternative corridor north of Twin Peaks Road would not meet the project purpose and need and was eliminated from further consideration.

## TI Alternatives

After meeting the purpose and need analysis, alternatives were subjected to a more detailed level of analysis. Several different alternatives were selected for additional analysis. These included alternative TI configurations, alternative TI design options, and alternative TI alignments. Each of these are discussed below.

### *Alternative TI Configurations*

Several alternative TI configuration options were considered during the study, including a roundabout traffic interchange, a tight diamond interchange, and a Single Point Urban Interchange (SPUI). Each of these configuration options is discussed below.

#### *Alternative TI Configurations – Roundabout Traffic Interchange*

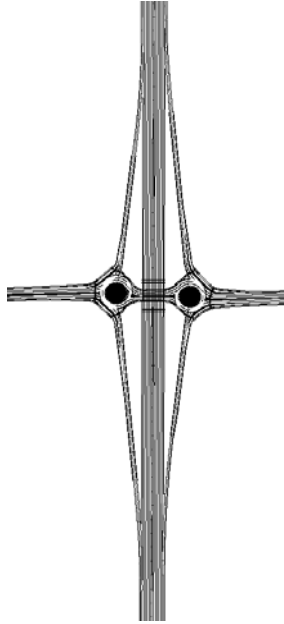
A roundabout traffic interchange consists of a circular intersection in which entering traffic yields to circulating traffic. The intersection is not signalized. Entering traffic aims at the central island and is deflected slowly around it. These characteristics may increase the capacity of the intersection, reduce maintenance costs, slow traffic speeds, and may reduce the frequency and severity of crashes. A typical roundabout interchange is presented in Figure 3-1.

Recently ADOT has considered roundabout intersections as possible alternatives for intersections of crossroads and frontage roads. Roundabouts have been constructed on freeway corridors in the Phoenix metropolitan area and were considered at the request of the Technical Advisory Committee for the Twin Peaks Road TI. Because the intersections of the crossroad and frontage roads at the proposed interchange would be elevated on fill, the construction of roundabouts on one or both sides of I-10 would present substantial design and construction challenges and would require additional right-of-way acquisition from property owners (including the railroad) in excess of that required by a tight-diamond interchange. As a result, the roundabout was eliminated from additional consideration.

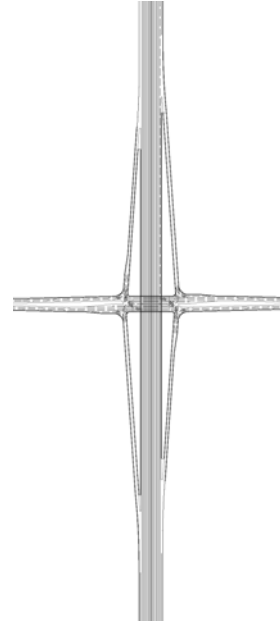
#### *Alternative TI Configurations – Tight Diamond Interchange*

The diamond interchange is one of the most prevalent TI designs and is commonly used throughout Arizona. A full diamond is formed when a one-way diagonal ramp (either an on-ramp or off-ramp) is provided in each quadrant of the interchange. The ramps terminate at the crossroad and at-grade left turns are confined to the crossroad. The diamond interchange has several advantages: traffic can enter and leave the major road at relatively high speeds; left-turning maneuvers entail little extra travel; and, a relatively narrow right-of-way is needed. A typical diamond interchange is presented in Figure 3-2.

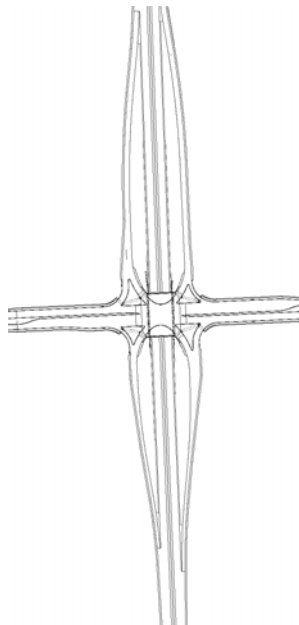
**Figure 3-1.  
Typical Roundabout Interchange**



**Figure 3-2.  
Typical Diamond Interchange**



**Figure 3-3.  
Typical Single Point Urban Interchange**



### Alternative TI Configurations - Single Point Urban Interchange

The SPUI is a form of diamond interchange with a single signalized intersection through which all left turns utilizing the interchange must travel. Right turns into and out of ramp approaches are generally free flow. SPUIs are typically characterized by narrow right-of-way, higher construction costs, and greater capacity than conventional tight diamond interchanges. The primary operational advantage of the SPUI is that vehicles making opposing left turns pass to the left of each other rather than to the right, so their paths do not intersect. A typical SPUI is presented in Figure 3-3.

The SPUI interchange configuration with one-way frontage roads would result in reduced operational efficiency and increased delays compared to the diamond configuration. This operational difficulty would be exacerbated by accommodating pedestrian movements. As a result, the SPUI was eliminated from additional consideration and a tight diamond interchange was selected as the preferred interchange configuration.

### ***Alternative TI Design Options - Twin Peaks Road Over or Under I-10 and UPRR***

After a tight diamond interchange configuration was selected, the method of crossing I-10 and the UPRR was the next issue to be considered. The new roadway could either cross over I-10 and the UPRR on bridge structures or could pass under I-10 and the UPRR as a depressed facility. At the Public Open House held on October 20, 2003, several individuals suggested that the underpass design option be considered, because this design is in place at the I-10/Orange Grove Road TI.

The underpass option was considered previously in the *Change of Freeway Access Report, I-10 Corridor Improvements General Plan Ruthrauff Road to Tangerine Road*, dated December 1991. The *Change of Freeway Access Report* preferred the over design because it: 1) provided the greatest flexibility in allowing corridor improvement to take place without being dependent on interchange improvements; 2) minimized right-of-way acquisition; and, 3) provided a grade separated UPRR crossing, which would minimize future traffic delays and improve safety.

To determine if the preferred design option selected in the *Change of Freeway Access Report* was still valid, the over and under design options were compared using design characteristics, social, economic and environmental affects, estimated costs, and ease of construction. The results of this analysis are presented below by design option.

### Alternative TI Design Options - Twin Peaks Road Under I-10 and UPRR

The underpass option had several major disadvantages, including:

- A temporary relocation of the current railroad alignment would be required and disruption of train traffic would result;
- Utilities between the railroad and I-10 mainline would require relocation, including underground petroleum lines, which would be especially difficult and expensive to relocate.

- Shallow groundwater (60 feet below ground surface) would require dewatering (removal of shallow groundwater) during construction and regular dewatering of the underpass after construction could be required.
- To convey stormwater runoff collected in the underpass to the Santa Cruz River, pumping facilities would be required, which would result in higher personnel and maintenance costs.
- The underpass would require 24-hour roadway lighting for security, traffic safety, and to accommodate pedestrian and bicycle traffic.
- To accommodate the eventual shift in the I-10 mainline alignment recommended in the *I-10 General Plan*, an I-10 bridge over Twin Peaks Road would need to be excessively wide. To accommodate the future elevation increase proposed for the I-10 mainline in the *I-10 General Plan*, reconstruction of the I-10 mainline to match the change in elevation at the bridge would be required. The excess bridge width and reconstruction of the I-10 mainline would add considerable costs to the Twin Peaks Road TI.

Advantages of the underpass option included:

- Relocation of overhead electric transmission lines and support structures would not be required.
- Twin Peaks Road would pass under I-10; therefore, there would be less visual effects to users of I-10. In addition, an underpass would be less visible, although the bridge over the Santa Cruz River would still be visible.
- Less traffic noise would be expected to emanate from a depressed structure than an elevated structure; therefore, traffic noise mitigation could be less extensive.

*Alternative TI Design Options - Twin Peaks Road Over I-10 and UPRR*

Disadvantages of the overpass option included:

- Train traffic could be disrupted during placement of the bridge deck and possibly other phases of railroad bridge construction.
- The overpass structures would be visible from I-10 and to area residents.
- More traffic noise would be expected to emanate from an elevated structure than a depressed structure; therefore, traffic noise mitigation could be more extensive.

Advantages:

- Less disruption to train traffic would be expected than with the underpass alternative.
- Users of the bridge would experience a greater range of views.
- The bridge structure would offer the opportunity for public art treatments visible from I-10 and at greater distances.

- Relocation of underground utilities between the railroad and I-10 mainline would not be extensive.
- Pumping facilities would not be required to convey stormwater runoff to the Santa Cruz River.
- Less extensive roadway lighting would be required.
- Construction of a bridge would not be expected to involve extensive dewatering of groundwater during and after construction.
- Eventual I-10 mainline realignment could be accommodated by bridge design without reconstruction of the existing I-10 mainline.

The disadvantages of the underpass design option were considered much more substantial than those of the overpass design option; therefore, the overpass option was selected as the preferred design option. As a result, the design option of Twin Peaks Road crossing under both I-10 and the UPRR was eliminated from further consideration.

## Alternative TI Alignments

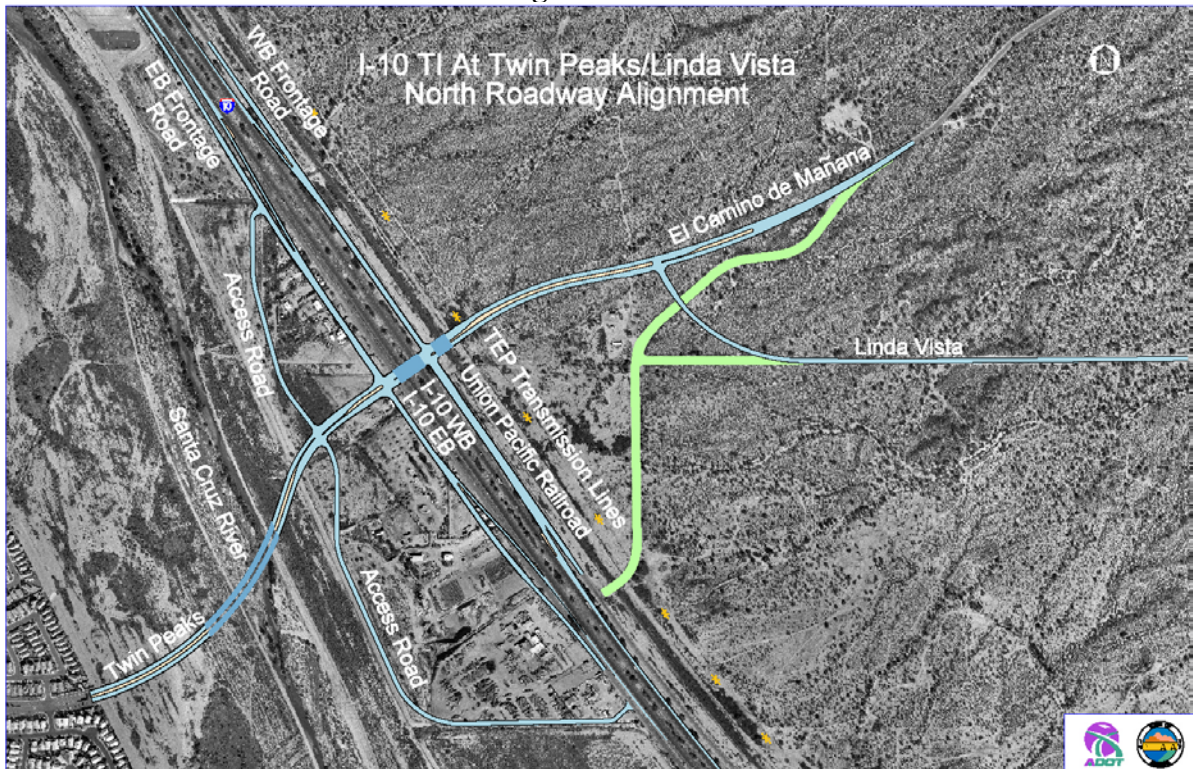
After selecting a tight diamond interchange with a Twin Peaks Road overpass of I-10 and the UPRR, alternative alignments for the overpass were developed. The range of alignment alternatives was defined and each alignment alternative was compared based on design characteristics, social, economic and environmental affects, cost, and constructability.

The range of alternative alignments was framed by required or desirable design characteristics. For this project, a set of design criteria was established for the I-10 mainline, the Twin Peaks Road TI and ramps, and approaching roadways (Twin Peaks Road, Linda Vista Boulevard, and El Camino de Mañana). Roadway design criteria contained in the ADOT *Roadway Design Guidelines* were used for the design of freeways, frontage roads, ramps, cross roads, and other roadway infrastructure within ADOT right-of-way. All other roadways used design criteria contained in the Pima County *Roadway Design Manual*. The north and south alignment limits were established by applying the Twin Peaks Road design speed of 50 mph and the corresponding maximum allowable roadway curvature; therefore, three alternative alignment alternatives were evaluated: north, center, and south alignments. These alignments are presented in Figures 3-4A-C.

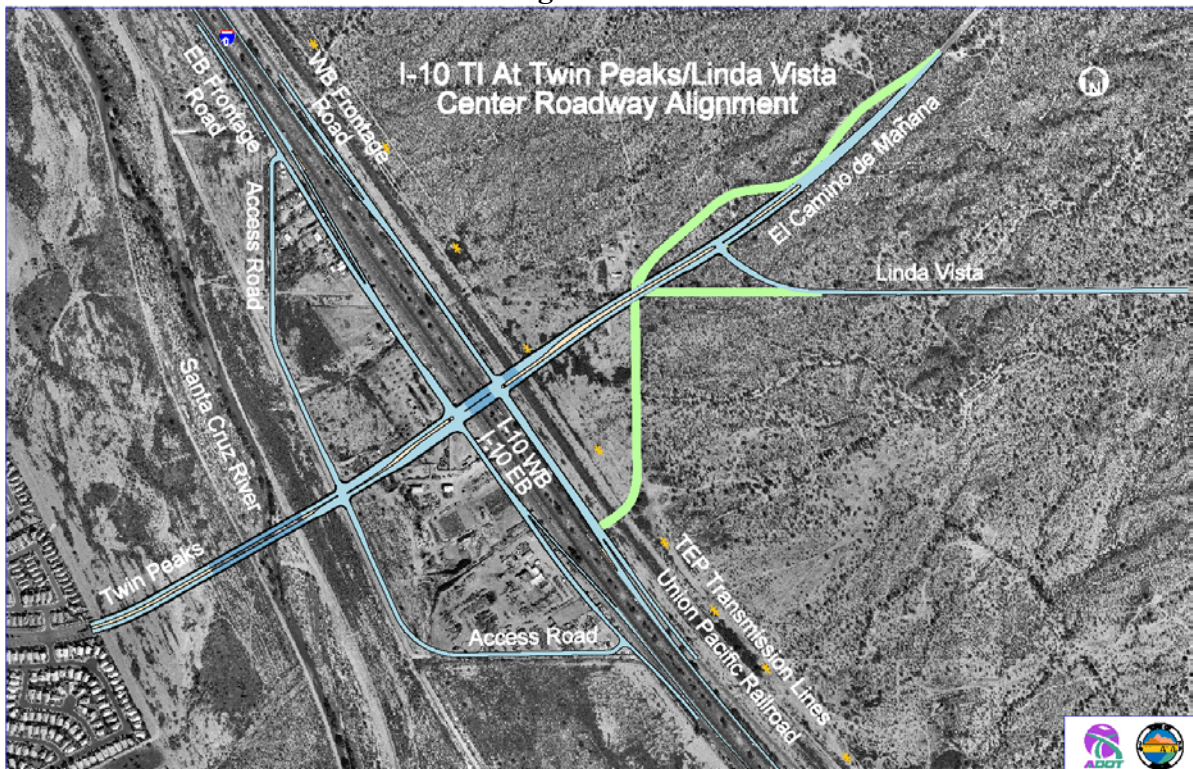
The roadway design was complicated by the proximity of the UPRR tracks to the 138 kilovolt transmission line towers east of I-10 (approximately 150 feet apart), which forced the design to “thread the needle” between the two structures (avoiding the relocation of the transmission line towers was considered desirable). Railroad safety standards require that the bottom of the bridge crossing the UPRR be a minimum of 23 feet above the railroad track surface and the Electric Safety Code requires a minimum of 22 feet of clearance between the overhead transmission lines and the roadway to provide safe vehicle passage below the lines. Because the transmission lines sag between towers, alignments were located close to the towers to meet the required vertical clearance.



**Figure 3-4. Alignment Alternatives  
A. North Alignment Alternative**

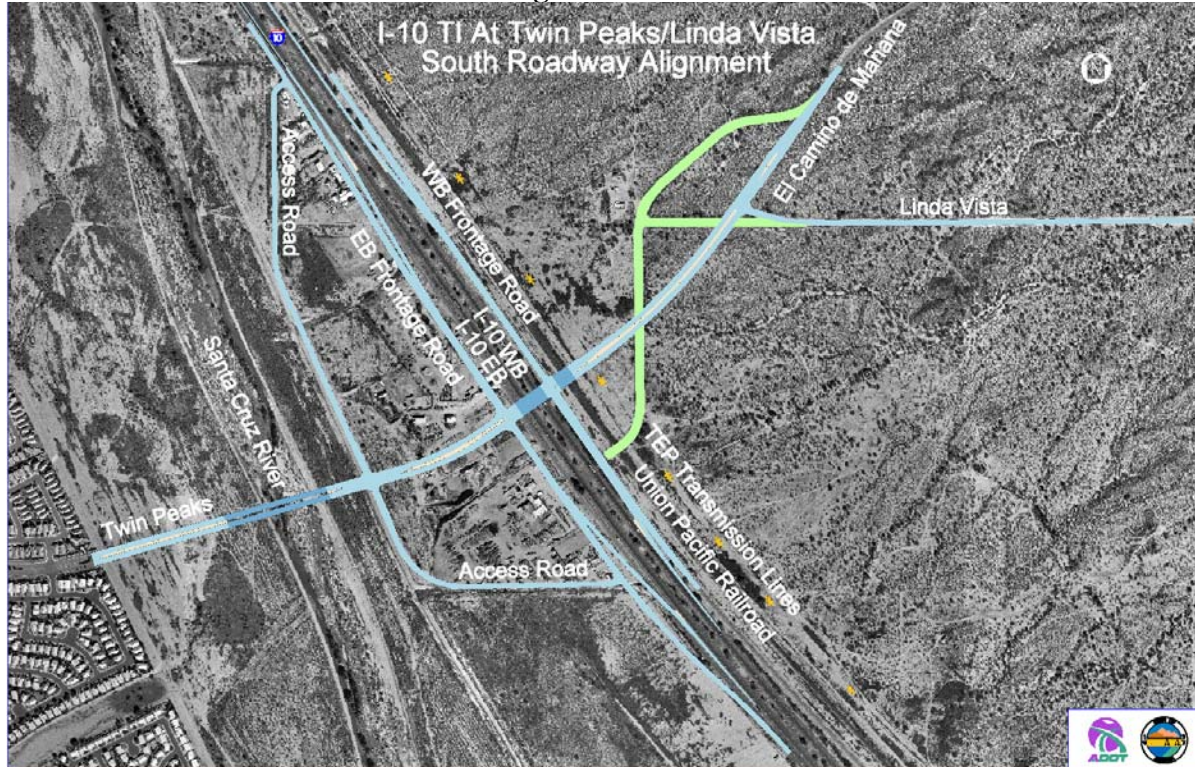


**Figure 3-4. Alignment Alternatives  
B. Center Alignment Alternative**





**Figure 3-4. Alignment Alternatives**  
**C. South Alignment Alternative**



The Twin Peaks Road TI alignment alternatives had many similarities. These included:

- All would construct a new four-lane divided roadway that would connect the end of Twin Peaks Road, west of the Santa Cruz River with a new signalized intersection of Linda Vista Road and El Camino de Mañana.
- The I-10 frontage roads would be reconstructed to accommodate the Twin Peaks Road TI and the existing two-way segment of the eastbound frontage road would be converted to one-way operation.
- The I-10 frontage roads within the Twin Peaks Road TI limits would be constructed in accordance with the ultimate improvements outlined in the *I-10 General Plan*. All alternatives would extend the I-10 right-of-way west to accommodate the eventual shift in alignment of the I-10 mainline.
- Drainage improvements would be provided to protect the roadways against flooding. ADOT, Pima County, and Town of Marana requirements for safe and efficient roadway design would be included in each alternative.

All alignment alternatives would construct also a two-way supplemental access road to compensate partially for the effects of right-of-way acquisition and the loss of access near the proposed Twin Peaks Road TI. Currently businesses in the area depend on access to the eastbound frontage road and this access would be either eliminated or modified with the construction of the Twin Peaks Road TI. According to ADOT's *Roadway Design Guidelines*, access onto the frontage roads should be prohibited from slightly beyond the ramp/frontage road intersection through the intersection with the cross road (Twin Peaks



Road). Prohibiting access in this area would minimize conflicts between low speed vehicles turning into and out of driveways with traffic exiting and entering the interstate at high speeds. The two-way circulation roadway around the west side of these properties would allow properties near the Twin Peaks Road TI to access Twin Peaks Road directly and I-10 and the frontage roads indirectly after frontage road access would be eliminated (see access road in Figures 3-4A-C).

The alignment alternatives were presented to the businesses surrounding the proposed TI on March 12 and 15, 2004 and to the general public on March 22, 2004. Almost no support was expressed for the north alignment. Many participants stated a preference for roadway alignments with fewer curves and a straighter alignment of Twin Peaks Road, but no clear preference between the central and the south alignments was demonstrated. The analysis of alternative alignments was documented in the *Alternatives Selection Report* prepared for this project. Although readers are referred to the *Alternatives Selection Report* for a more thorough discussion, the results of the analyses are summarized here.

- The Center Alternative had the lowest construction costs.
- The Center Alternative required four fewer acres of additional right-of-way and fewer total property takes.
- The Center Alternative exhibited the most desirable design characteristics.
- The Center Alternative exhibited the most favorable environmental characteristics. These included:
  - least visual affects;
  - least displacement of habitat in the low flow and high flow channels of the Santa Cruz River;
  - least displacement of wetlands; and,
  - avoided documented cultural resources.

As documented in the *Alternatives Selection Report*, the center alignment was selected to be carried forward for detailed analysis in the EA and design phases of the project. This alternative was selected because: it was the least cost alternative and minimized additional right-of-way acquisition and total property takes; it exhibited the most desirable design characteristics; it did not exhibit substantial disadvantages in comparison to the north and south alignments; and, it was generally preferred by the affected property owners and the public.

Subsequent to the selection of the center alignment as the preferred alignment, design changes were required. The UPRR proposed to add a second track on the east side of the existing track and to increase the elevation of the added track above that of the existing track. In addition, revised traffic projections indicated that additional traffic lanes on the bridge over the UPRR may be needed. As a result, the height of the bridge over the UPRR was adjusted and the bridge width was increased to accommodate more traffic lanes at a later time. These design changes made it impossible to “thread the needle” between the UPRR tracks and the TEP towers. As a result, the relocation or the raising of one or more of the transmission line towers would be required. However, relocation or raising one or

more of the transmission line towers would be required for all of the alignment alternatives and would not influence the selection of center alignment alternative.

The proposed improvements associated with the preferred alignment and the no build alignment are discussed below.

## Alternatives Selected for Further Study

### *No Build Alternative*

The no build alternative would not construct an additional interchange on I-10, would not extend Twin Peaks Road, El Camino de Mañana or Linda Vista Boulevard to I-10, would not eliminate the at-grade crossing of the UPRR at El Camino de Mañana, would make no safety improvements to the I-10 frontage roads in the area, would not acquire additional right-of-way in the study area, and would not convert the two-way frontage road along the west side of I-10 to a one-way frontage road. No improvements would be made to any of the affected roadways except for those activities currently planned and programmed and routine maintenance. As a result, existing and future deficiencies in roadway design, roadway congestion on Cortaro Road and Silverbell Road, stormwater flowing over the I-10 mainline and frontage roads, motor vehicle conflicts with the railroad, and bicycle, pedestrian, and general transportation system connectivity deficiencies would continue. Current trends of declining traffic operations and increasing crashes would be expected to continue also. The no build alternative is illustrated in Figure 3-5.

**Figure 3-5. No Build Alternative**

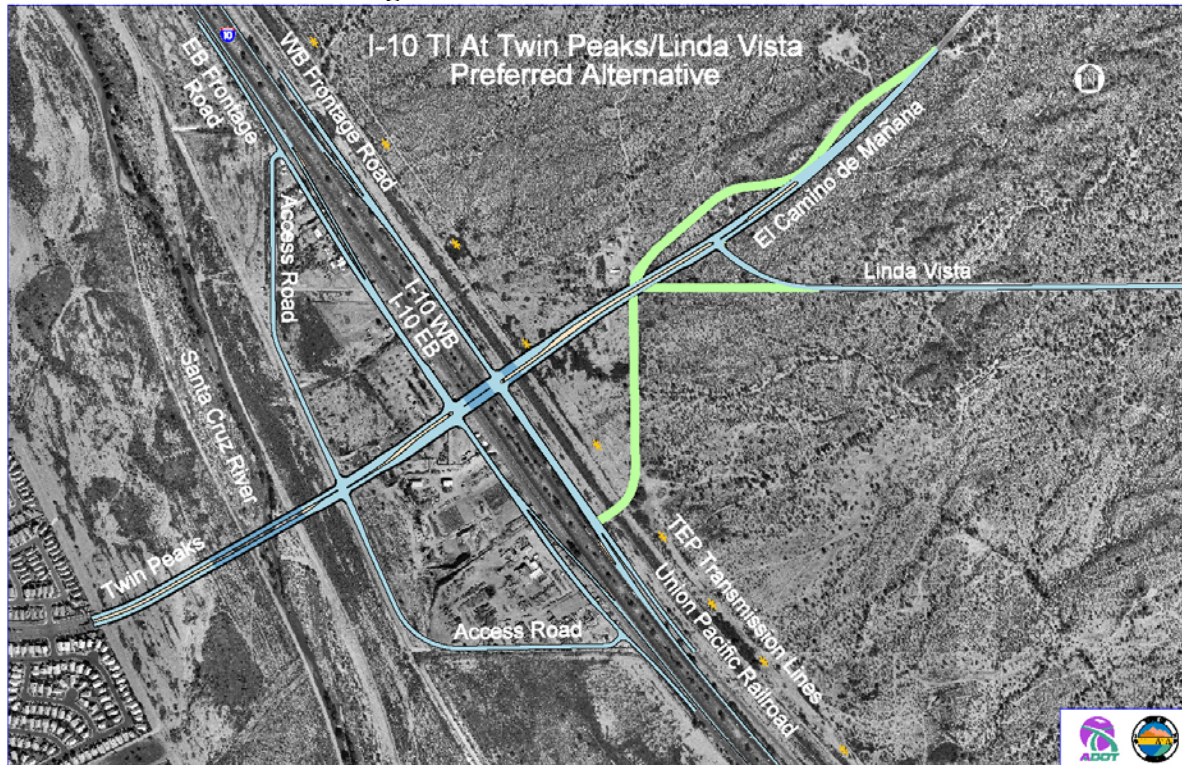




## Preferred Alternative

Constructing a Twin Peaks Road TI with I-10 as a tight diamond interchange along the center alignment was selected as the preferred alternative. The specific improvements associated with this alternative are discussed below and illustrated in Figure 3-6.

**Figure 3-6. Preferred Alternative**

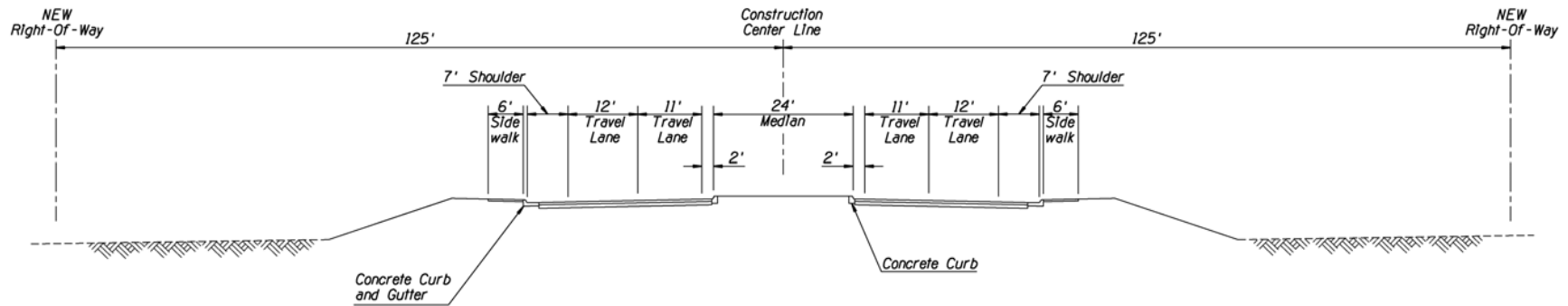


### *Proposed Roadway Improvements*

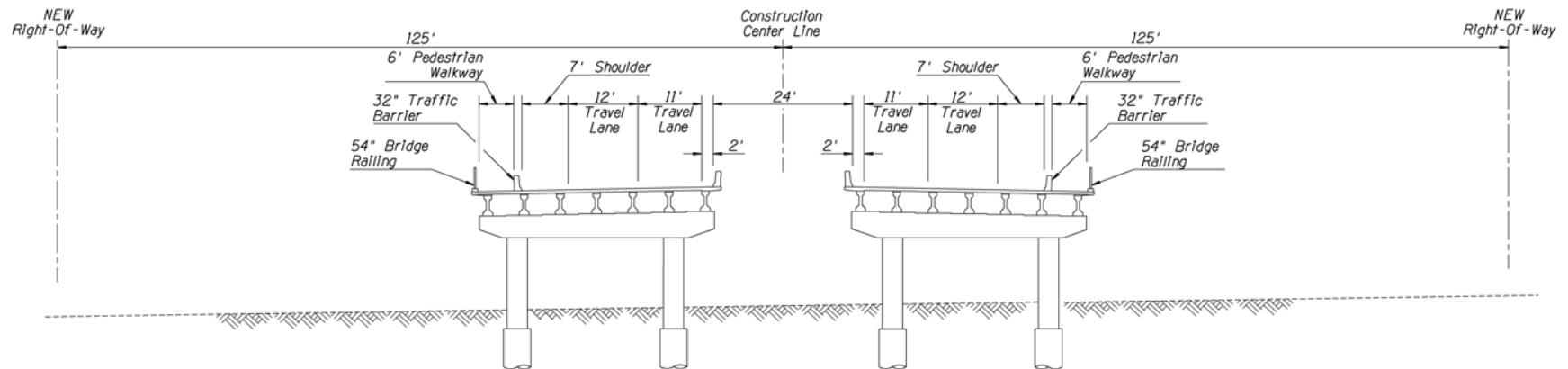
#### *Twin Peaks Road*

A new four-lane divided roadway would be constructed that would connect Twin Peaks Road, west of the Santa Cruz River, with a new signalized intersection of El Camino de Mañana and Linda Vista Road on the east side of I-10. A typical section (a slice across the roadway) of Twin Peaks Road would consist of 11-foot wide inside lanes and 12-foot wide outside lanes, as shown in Figure 3-7. Shoulders 7 feet in width that may be used by bicycles and a 6-foot wide sidewalk would be provided on both sides of the roadway. A raised center median that varies in width would be provided along most of Twin Peaks Road. The median would not be provided where the roadway crosses the Santa Cruz River, because directional traffic would be separated onto two bridge structures. The total right-of-way width would vary between 200 and 300 feet. This roadway section would be maintained through the intersection with Linda Vista Boulevard and then transition to a two-lane section to match the existing roadway section of El Camino de Mañana.

**Figure 3-7. Proposed Twin Peaks Road Typical Section (a slice across the roadway)**



**Figure 3-8. Proposed Twin Peaks Road Bridge Crossing over the Santa Cruz River Typical Section**





Twin Peaks Road would cross the Santa Cruz River, I-10, and the UPRR on bridge structures. The roadway would approach the Santa Cruz River on both sides on embankment and then cross the Santa Cruz River on twin bridge structures of approximately 750 feet in length. A typical section of the Twin Peaks Road bridge crossing of the Santa Cruz River is shown in Figure 3-8 and would consist of 11-foot wide inside lanes and 12-foot wide outside lanes. Shoulders 7 feet in width that may be used by bicycles and a 6-foot wide sidewalk would be provided on both sides of the roadway. The sidewalk would be physically separated from the shoulder by a concrete barrier 32 inches in height. The bottom of the bridge would be approximately 20 feet above the low flow channel of the Santa Cruz River.

Twin Peaks Road would rise again on embankment approaching I-10 from the west and approaching the UPRR tracks from the east. The roadway would cross I-10 on a bridge of slightly over 200 feet in length approximately 24 feet above the exiting I-10 roadway surface. According to the I-10 *General Plan*, the elevation of I-10 would be raised in this area; therefore, after the modifications to I-10, the bottom of the bridge would be slightly over 17 feet above the I-10 roadway surface. A typical section of the Twin Peaks Road bridge crossing of I-10 and the UPRR is shown in Figure 3-9.

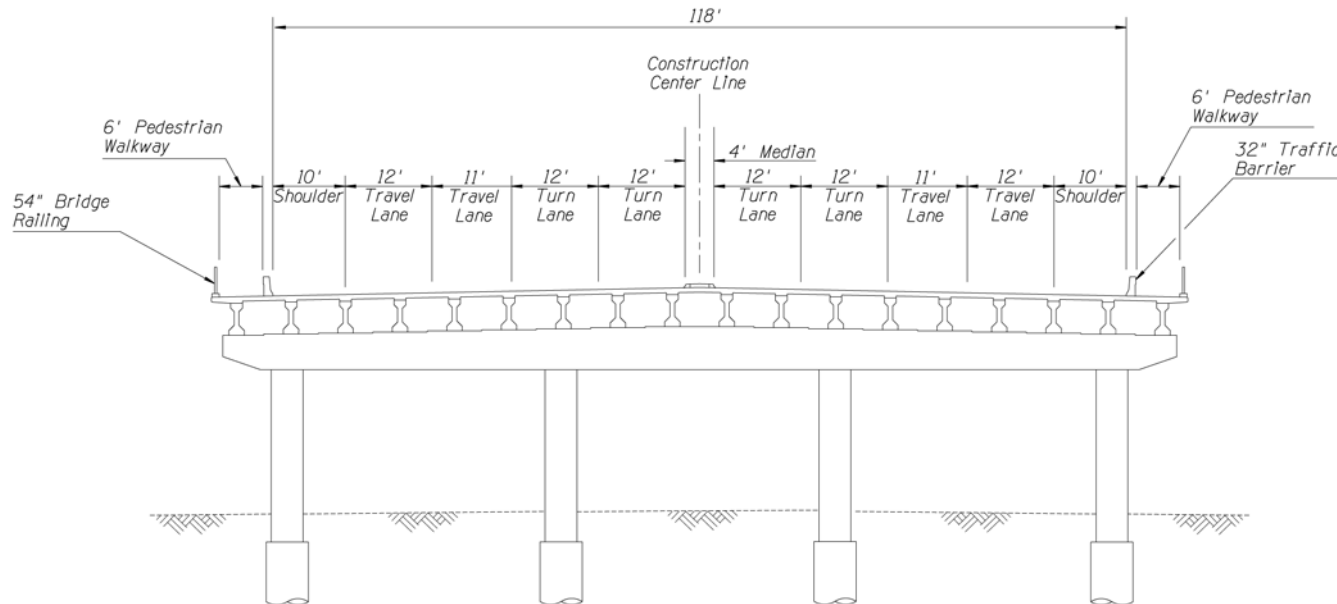
Twin Peaks Road would cross over the UPRR tracks on a bridge approximately 130 feet in length. The UPRR plans to add an additional track on the east side of the existing track (double track) to increase the capacity of the line; therefore, the bridge length would accommodate the additional future track. The bottom of this bridge would be 23.5 feet above the track surface to meet railroad safety standards. The roadway would approach the railroad on embankment on both sides. The embankment would continue to the east until the roadway matched the existing terrain, approximately 750 feet east of the UPRR.

The existing surface of Twin Peaks Road through Continental Ranch is in fair to poor condition. The pavement shows signs of low to medium severity deterioration, rutting, and various types of cracking such as block, longitudinal, and transverse cracking. This project proposes to mill and resurface Twin Peaks Road to Silverbell Road with rubberized asphaltic concrete (RAC) which would improve drivability of the roadway. An RAC surface also decreases the noise generation from the tire-pavement interface. Although the FHWA will not participate in the funding of roadway resurfacing with RAC, the Town of Marana will provide the funding for this rehabilitation.

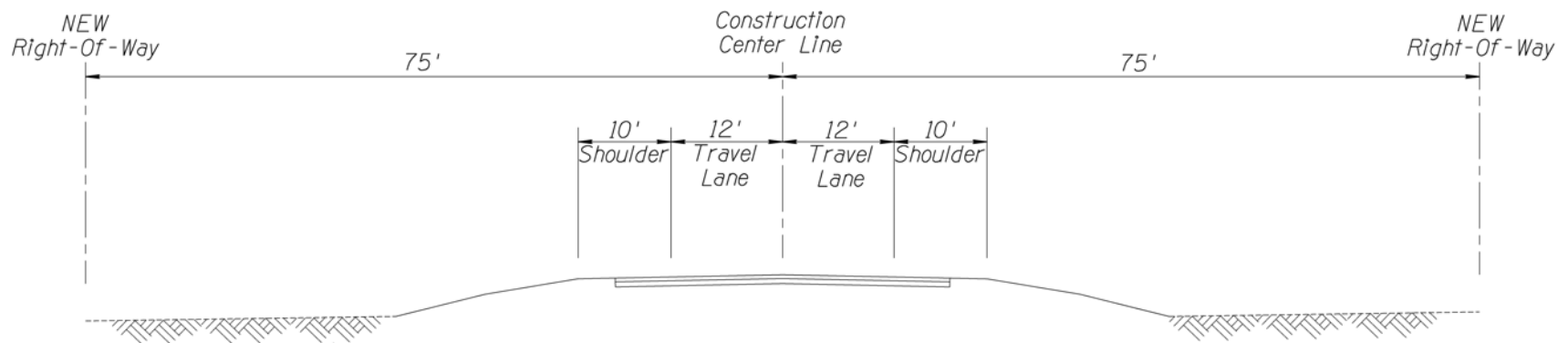
#### Access Road

The two-way supplemental access road was proposed to partially mitigate the effects of the potential additional right-of-way acquisition and the loss of access near the Twin Peaks Road TI. The access road would connect the I-10 eastbound frontage road north and south of the Twin Peaks Road TI and intersect with Twin Peaks Road, east of the Santa Cruz River. A typical section of the access road would consist of a two-lane roadway with 12-foot wide travel lanes and 10-foot wide shoulders, 6 feet of which would be paved. The total right-of-way width would be 150 feet. A typical section of the access road is shown in Figure 3-10.

**Figure 3-9. Proposed Twin Peaks Road Bridge Crossing over I-10 and the UPRR**



**Figure 3-10. Proposed Access Road Typical Section**



### I-10 Frontage Roads

New two-lane, one-way frontage roads would replace the current frontage roads near the Twin Peaks Road TI. The frontage roads would be positioned in accordance with the planned future improvements to I-10 specified in the *General Plan* and the 1993 EA. The eastbound frontage road would be reconstructed and relocated approximately 100 feet west of its existing location in accordance with the proposed future I-10 widening to 8 lanes and proposed I-10 on and off ramps. Proposed right-of-way acquisition for this project would be sufficient to accommodate these roadway improvements. The westbound frontage road would be reconstructed in the vicinity of the Twin Peaks Road TI to accommodate the grade-separated TI structure and to accommodate the I-10 on and off ramps; therefore, additional right-of-way would not be acquired along the east side of I-10.

Typical sections of the frontage roads and ramps are shown in Figures 3-11 and 3-12. The typical section would consist of two lanes, each 12 feet in width with 8-foot inside and outside shoulders. The new frontage roads would have a posted speed limit of 45 mph. Stop sign control would be provided on the frontage roads just prior to merging with the I-10 off-ramps. The eastbound frontage road would be converted to one-way operation from the Avra Valley TI south to the Cortaro Road TI and would result in one-way frontage road operation from the Avra Valley TI to the 29<sup>th</sup> Street TI.

Encroachments into the clear zone of the existing frontage roads would be addressed with the proposed improvements. Additional right-of-way acquisition in the area of the proposed reconstruction and relocation of the eastbound frontage road would allow recommended clear zone widths to be provided. Along the westbound frontage road, concrete headwalls of irrigation structures are within approximately 6 feet of the roadway. A cost-benefit analysis of the clear zone obstructions along the westbound frontage road and beyond the area of eastbound frontage road reconstruction would be conducted. Depending on the results of this analysis, obstructions within the clear zone would either remain, be removed, or an energy absorbing barrier (i.e. guardrail) would be placed between the obstruction and the roadway.

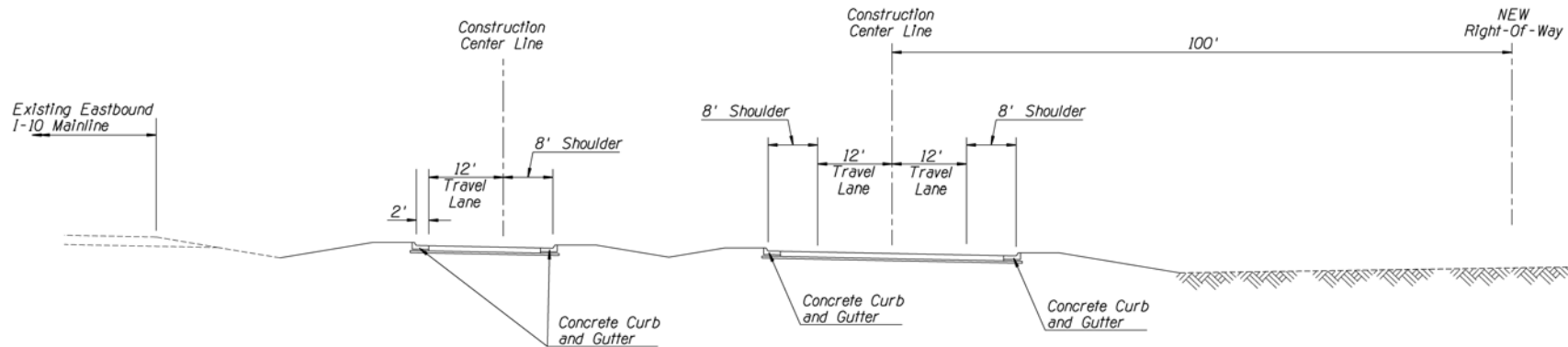
### I-10

Modifications proposed to the I-10 mainline are limited to transitions into and off the roadway in both directions to serve the Twin Peaks Road TI on and off ramps. Although no other modifications to the I-10 mainline are proposed as a part of this project, the proposed improvements would be designed in accordance with the completion of the mainline improvements specified in ADOT's *I-10 General Plan* and the 1993 EA.

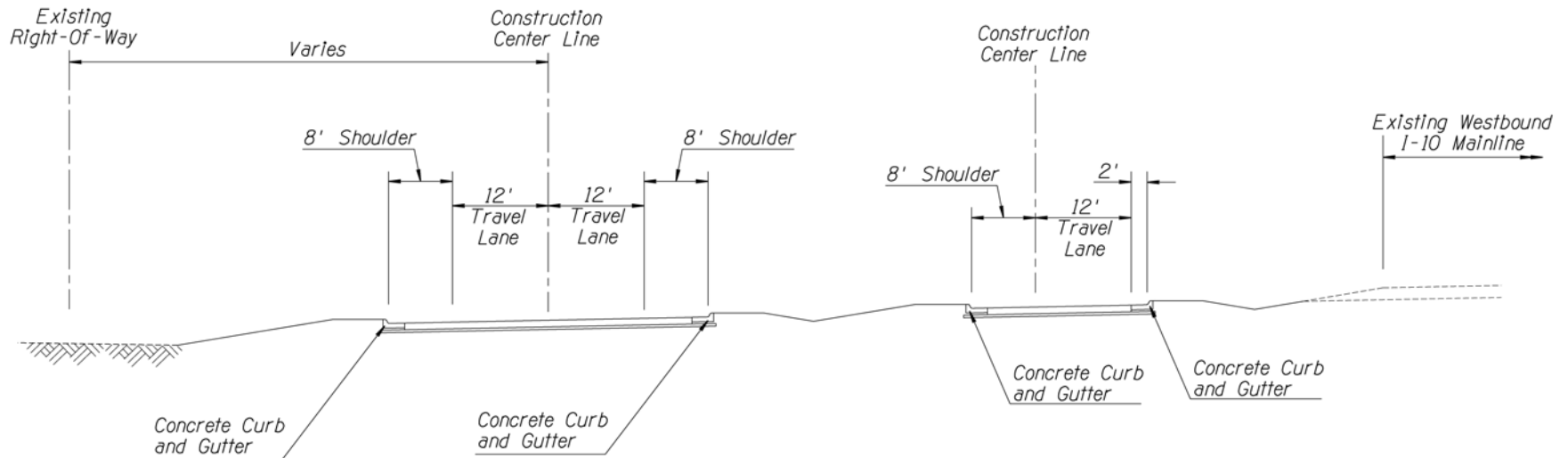
### El Camino de Mañana

The preferred alternative would remove the at-grade crossing of El Camino de Mañana with the UPRR. The roadway east of the UPRR would be retained for access to the Tucson Electric Power (TEP) transmission line and towers in the area and to provide access to adjacent properties. The proposed improvements would reconstruct the intersection of

**Figure 3-11. Proposed I-10 Eastbound Frontage Road and Ramps Typical Section**



**Figure 3-12. Proposed I-10 Westbound Frontage Road and Ramps Typical Section**





Linda Vista Boulevard and El Camino de Mañana approximately 500 feet northeast of its current location and straighten the roadway. As a result, a portion of the existing El Camino de Mañana north of the existing intersection with Linda Vista Boulevard would be abandoned.

### Linda Vista Boulevard

The preferred alternative would reconstruct Linda Vista Boulevard from its new intersection with El Camino de Mañana for approximately 0.7 miles to the east. The roadway and subgrade would be reconstructed as a two-lane all weather roadway section with 12-foot wide travel lanes, and 10-foot wide shoulders, 6 feet of which would be paved and may be used by bicycles. A typical section of Linda Vista Boulevard is shown in Figure 3-13. Sidewalks would not be provided along Linda Vista Boulevard because: (1) the proposed roadway would not be provided with curb; therefore, pedestrians would not be separated from vehicles by the curb and unsafe conditions for pedestrians would result; (2) the addition of sidewalk now would require replacement whenever roadway improvements to Linda Vista Boulevard occur; (3) the area is characterized by low density residential development; and, (4) as the area develops, the Town of Marana will require developers to construct the sidewalk. New right-of-way would be acquired within the area proposed for reconstruction to produce a total right-of-way width of 150 feet.

Linda Vista Boulevard east of the tie-in point would not be modified. The roadway structure is adequate to withstand the higher traffic volumes caused by the project, but the design life of the roadway may be reduced; therefore, the roadway may require more frequent maintenance.

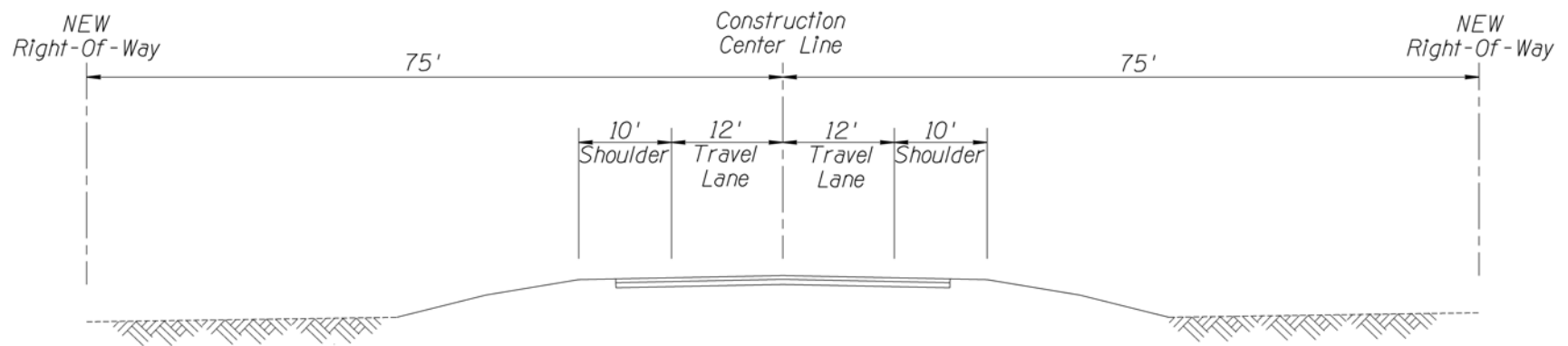
### ***Proposed Intersection Improvements***

Twin Peaks Road/Silverbell Road/Scenic Drive is an unsignalized, unlighted intersection with stop sign control on the Twin Peaks Road and Scenic Drive approaches. The westbound (Twin Peaks Road) approach provides single dedicated left-turn and right-turn lanes and one through lane, while the eastbound approach (Scenic Drive) provides a single lane. The northbound Silverbell Road approach provides a dedicated left-turn, right-turn, and a single through lane, while the southbound approach provides one through lane and a dedicated left-turn lane. According to the *Traffic Report*, projected peak hour traffic volumes for the implementation year (2008) are projected to merit signalization; therefore, a traffic signal at this intersection would be provided.

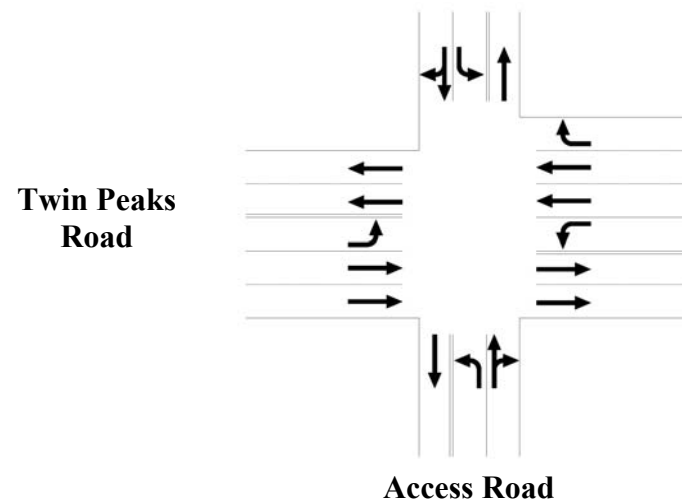
Twin Peaks Road/Coachline Boulevard is an unsignalized, unlighted intersection with four-way stop control. All approaches provide a dedicated left-turn lane and two through lanes. According to the *Traffic Report*, projected peak hour traffic volumes for the implementation year (2008) are projected to merit signalization; therefore, a traffic signal at this intersection would be provided.

Twin Peaks Road would meet the two-way access road at a signalized intersection. The lane configuration of the proposed Twin Peaks Road/access road intersection is shown in Figure 3-14. This intersection would be illuminated and bicycle striping would be carried through the intersection. Crosswalk and pedestrian actuated signals would be provided.

**Figure 3-13. Proposed Linda Vista Boulevard Typical Section**

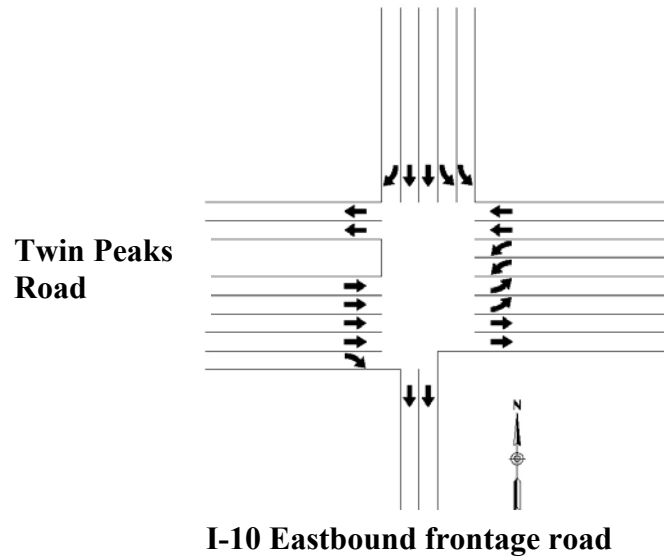


**Figure 3-14. Proposed Twin Peaks Road/Access Road Intersection Configuration**

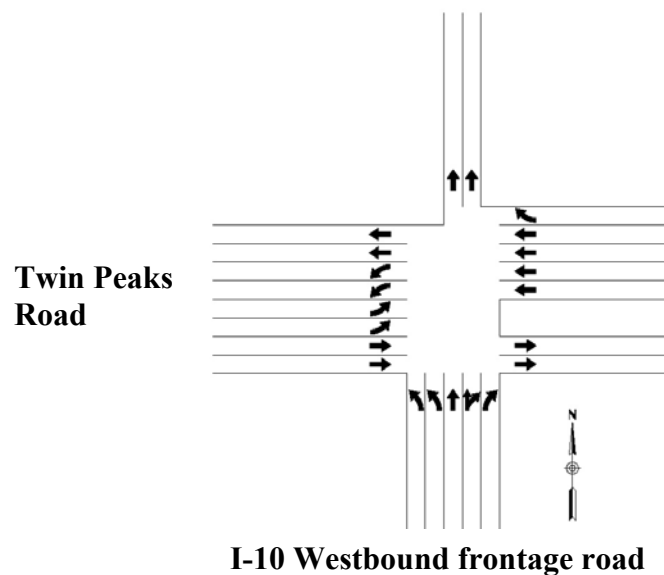


Twin Peaks Road would form signalized intersections with the I-10 frontage roads east and west of I-10. The lane configurations of the proposed intersections of Twin Peaks Road with the eastbound and westbound frontage roads are shown in Figures 3-15 and 3-16, respectively. Both intersections would be illuminated and bicycle striping would be carried through the intersection. Crosswalk and pedestrian actuated signals would be provided.

**Figure 3-15. Proposed Twin Peaks Road/Eastbound Frontage Road Intersection Configuration**

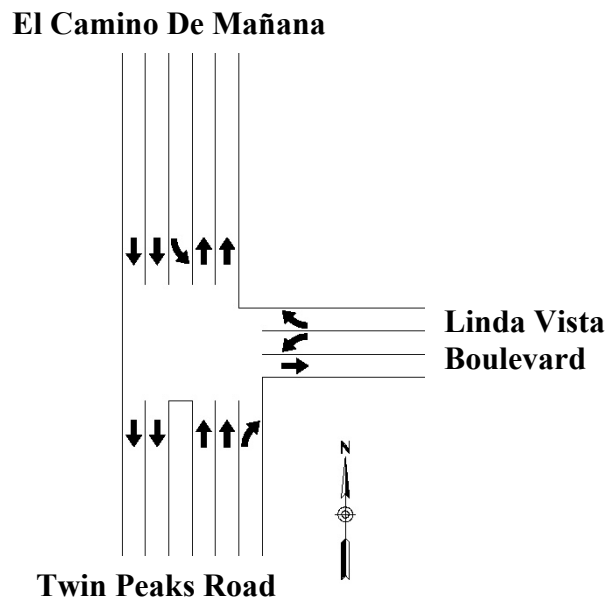


**Figure 3-16. Proposed Twin Peaks Road/Westbound Frontage Road Intersection Configuration**



The preferred alternative would construct a new Twin Peaks Road/El Camino de Mañana/Linda Vista Boulevard signalized intersection approximately 650 feet northeast of the existing El Camino de Mañana/Linda Vista Boulevard intersection. The proposed intersection configuration is shown in Figure 3-17. This intersection would be illuminated and bicycle striping would be carried through the intersection. Crosswalk and pedestrian actuated signals would be provided. Past the intersection, the roadway would transition to a two-lane roadway to match the existing section of El Camino de Mañana.

**Figure 3-17. Proposed Twin Peaks/El Camino De Mañana/Linda Vista Boulevard Intersection Configuration**



### ***Proposed Lighting Improvements***

New intersection lighting would be provided at all signalized intersections within the study area. These include the intersections of Twin Peaks Road and Silverbell Road, Coachline Boulevard, the access road, the Twin Peaks Road and the I-10 eastbound and westbound frontage roads, and the Twin Peaks Road/El Camino de Mañana/Linda Vista Boulevard intersection. In addition to intersection lighting, underdeck lighting would be provided under the bridges crossing I-10 and the UPRR. According to UPRR's *Guidelines for Design of Highway Separation Structures over Railroads (Overhead Grade Separations)* dated January 1999, underdeck lighting is required for bridges that exceed 80 feet in width.

### ***Proposed Bicycle and Pedestrian Facilities***

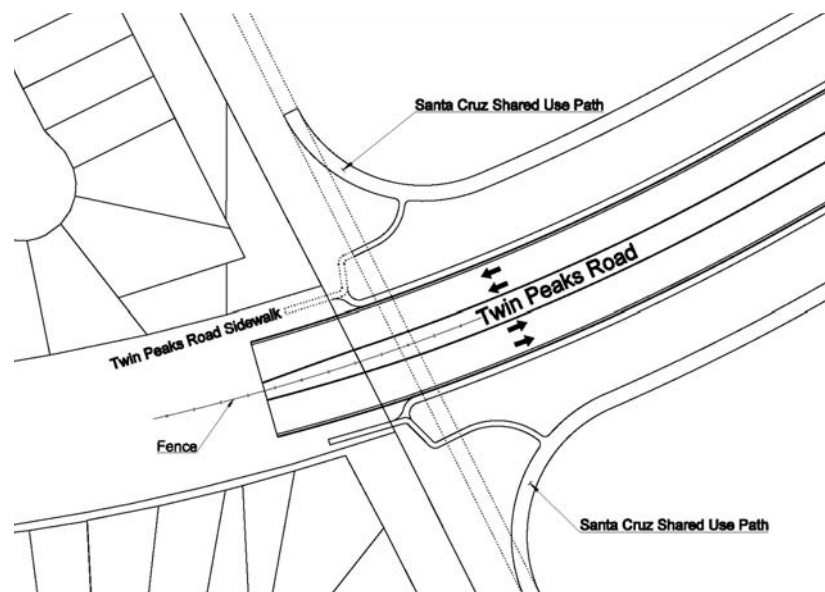
Inconsistent and discontinuous pedestrian and bicycle facilities exist within the project area. To promote the use of alternative modes of transportation and reduce vehicle trips, the existing bicycle lanes and sidewalk along Twin Peaks Road would be extended across the Santa Cruz River, across I-10 and the UPRR, and through the intersection of Twin Peaks Road/El Camino de Mañana/Linda Vista Boulevard. Along Twin Peaks Road, shoulders a minimum of 7 feet in width would be provided to accommodate bicycle use



and sidewalks would be 6 feet in width. Along the segment of Linda Vista Boulevard proposed for reconstruction, 6-foot wide paved shoulders could be used by bicycles, but sidewalks would not be provided. All sidewalks and proposed intersection improvements would provide crosswalks, sidewalk, and ramps that are compliant with the Americans with Disabilities Act (ADA) and resultant regulations.

The proposed project would provide pedestrian and bicycle connections between the existing sidewalk and shared use lanes on Twin Peaks Road and the Santa Cruz River Shared Use Path and the Juan Bautista de Anza Historic Trail east of Continental Ranch. The Santa Cruz River Shared Use Path is under final design currently and will be completed prior to the construction of the proposed improvements to Twin Peaks Road. As a result, reconstruction of the path at its intersection with Twin Peaks Road would be required. At-grade shared use path crossings of Twin Peaks Road were not recommended because of potential vehicle conflicts; therefore, users of the shared use path would be diverted along the Twin Peaks Road embankment approximately 850 feet east of the shared use path's alignment. In this location, both the Santa Cruz River Shared Use Path and the proposed Juan Bautista de Anza Historic Trail would cross Twin Peaks Road beneath the proposed Santa Cruz River Bridges. The connection to the Santa Cruz River Shared Use Path is illustrated in Figure 3-18.

**Figure 3-18. Proposed Twin Peaks Road Connection to Santa Cruz Shared Use Path**



To discourage pedestrian crossing of Twin Peaks Road at the former alignment of the Santa Cruz River Shared Use Path, the roadway's center median would be fenced for approximately 100 feet in length. This would direct path users to either cross under the Santa Cruz River Bridge or at the nearest intersection to the west (Twin Peaks Road and Clover Road).

During public information meetings on the Twin Peaks Road TI, the public expressed concerns regarding the safety of children attending Twin Peaks Elementary School (7995 West Twin Peaks Road). As a result, the Town of Marana chose Twin Peaks Elementary School as their initial Safe Routes to School program. A successful grant application

would result in the construction of a 4,500-foot long, 14-foot wide shared use path along the south side of Twin Peaks Road from Silverbell Road to Coachline Boulevard and along Coachline Boulevard from Twin Peaks Road to Desert Spirits Drive (approximately 725 feet south of Twin Peaks Road). Although the Twin Peaks Road TI project does not provide funding for this shared use path, the social, economic, and environmental effects of this path are addressed within this document to increase the probability of the grant application's success.

### ***Proposed Drainage Improvements***

Drainage issues in the study area were documented in the *Interstate 10 Traffic Interchange at Twin Peaks/Linda Vista Final Drainage Report*, dated May 21, 2004. Although readers are referred to the *Final Drainage Report* for a more thorough discussion, the results of the analyses are summarized here.

#### **Roadway Drainage**

Pavement drainage from Twin Peaks Road is collected currently by curb and gutter and transmitted to storm drains along the outsides of the roadway. Catch basins and storm drain pipe collect the drainage and transmit the water to drainage channels, which drain to tributaries of the Santa Cruz River. The western portion of Linda Vista Boulevard (near its intersection with El Camino de Mañana) and El Camino de Mañana have no curb and gutter and pavement drainage sheetflows off the roadway into small roadside ditches adjacent to the roadway.

Proposed improvements to Twin Peaks Road would use curb and gutter to collect pavement drainage. Catch basins and storm drain pipe would collect the runoff and transmit the water to the nearest cross drainage channels, which would drain eventually to the Santa Cruz River. Where curbs are proposed for Linda Vista Boulevard and El Camino de Mañana (near the El Camino De Mañana/Linda Vista Boulevard intersection only) the method of drainage would be the same as that described for Twin Peaks Road. Beyond the reaches of the intersection, runoff would flow off the roadway into roadside ditches and to the nearest cross drainage facility.

Due to the absence of curb and gutter, pavement drainage on the frontage roads is currently collected in roadside ditches and conveyed to existing cross culverts. Under proposed conditions, curb and gutter would be installed along portions of the frontage roads and a catch basin/storm drain system would be used to collect flows and convey them to the nearest cross drainage facility. In addition, median drainage would also be intercepted by the storm drain system for conveyance to the nearest cross drainage facility.

#### **Cross Culvert Design**

Drainage facilities under I-10 and the frontage roads were developed assuming the 50-year storm event in accordance with ADOT design criteria. The design considered existing box capacities and outfall angles in relation to receiving channels. In general, where existing facilities are proposed to be augmented, the existing culvert sizes were duplicated for the new culvert cell. Where feasible, larger cells were proposed to increase capacity and decrease the number of additional cells required for augmentation. The

proposed culvert locations and sizes under I-10 are compared with the existing structures in Table 3-1. The structure locations are illustrated in Figure 3-19.

<b>Table 3-1. Existing and Proposed I-10 and Frontage Road Drainage Structures</b>				
<b>Location (approximate I-10 Milepost)</b>	<b>Type of Improvement</b>	<b>Existing Size and Structure Under Frontage Road</b>	<b>Existing Size and Structure Under I-10 mainline</b>	<b>Proposed Size and Structures for both I-10 mainline and Frontage Road</b>
244.48	Augmentation / Extension	2 - 6-foot by 3-foot cells RCBC	2 - 8-foot by 3-foot cells RCBC	7 - 8-foot by 3-foot cells RCBC
244.81	Extension	2- 8-foot by 3.5-foot cells RCBC	2- 8-foot by 3.5-foot cells RCBC	No change – extend RCBC only
244.94	New Structure	New - N/A	New - N/A	6 – 10-foot by 4-foot cells RCBC
245.16	Replacement	3 - 8-foot by 4-foot cells RCBC	3 - 8-foot by 3-foot cells RCBC	3 – 10-foot by 4-foot cells RCBC
245.38	Replacement	3 - 5-foot by 2.5-foot cells RCBC	2 - 8-foot by 3-foot cells RCBC	4 - 8-foot by 4-foot cells RCBC
245.87	Augmentation / Extension	2 - 6-foot by 2.5-foot cells RCBC	2 - 8-foot by 3-foot cells RCBC	15 - 8-foot by 4-foot cells RCBC

Cross drainage stormwater would be transmitted under Twin Peaks Road and Linda Vista Boulevard by a combination of reinforced concrete pipes (RCP) and reinforced concrete box culverts (RCBC). The sizes of these structures were developed assuming the 100-year storm event in accordance with Pima County design criteria, because these drainage facilities are located outside ADOT right-of-way. The proposed culvert locations and sizes under Twin Peaks Road and Linda Vista Boulevard are shown in Table 3-2. The structure locations are illustrated in Figure 3-19.

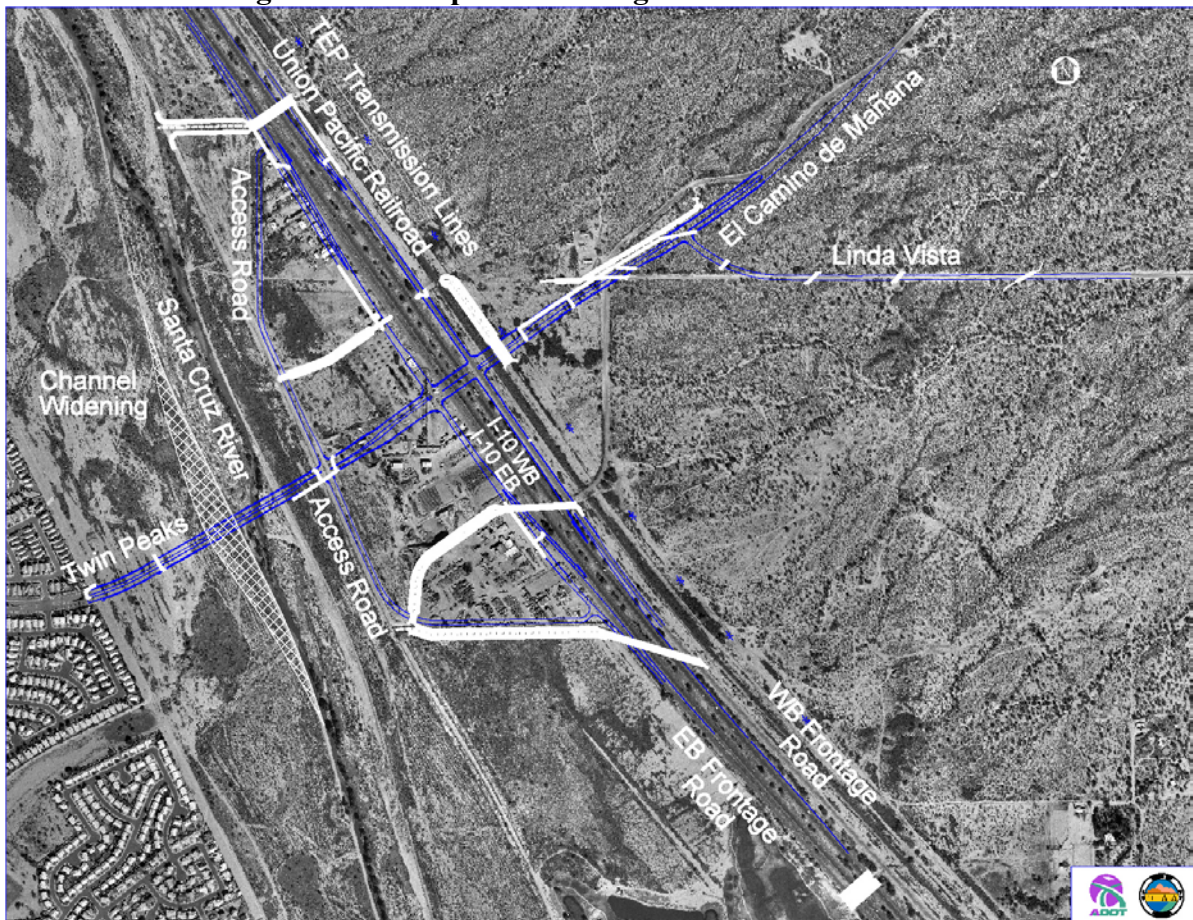
<b>Table 3-2. Proposed Twin Peaks Road and Linda Vista Boulevard Drainage Structures</b>	
<b>Location (Distance and Direction from Twin Peaks Road/El Camino de Mañana/Linda Vista Boulevard Intersection)</b>	<b>Proposed Structure and Size</b>
535 feet west	2 - 6-foot by 4-foot cells RCBC
400 feet east	1 – 8-foot by 4-foot cell RCBC
1,038 feet east	1 – 48-inch RCP
1,660 feet east	2 - 6-foot by 4-foot cells RCBC
2,595 feet east	2 - 36-inch RCP

### Channel Design

After stormwater runoff is carried under the roadways in culverts or pipes, it would be transmitted to the Santa Cruz River in open channels. Because the existing outfall channels downstream of the I-10 mainline and eastbound frontage road are located outside ADOT right-of-way, they were designed in accordance with Pima County requirements to convey the 100-year rainfall event. These channels discharge into the Santa Cruz River through openings in the soil cement bank protection.

The existing channels are undersized to convey 100-year rainfall events. As a result, the channels near I-10 would be either enlarged or replaced with larger structures. The location, structure, and size of these proposed improvements to drainage channels are compared to existing channels in Table 3-3. All proposed channels were designed to provide one foot of freeboard. The channel locations are illustrated in Figure 3-19. The proposed channel improvements would require widening existing discharge locations into the Santa Cruz River in two locations (the channel outfalls at approximate I-10 MPs require widening also). Flows would be slowed by grade control structures or similar means prior to discharging into the Santa Cruz River; therefore, energy dissipation structures within the Santa Cruz River channel would not be required.

**Figure 3-19. Proposed Drainage Facilities Near I-10**





Near the proposed intersection of Twin Peaks Road/El Camino de Mañana/Linda Vista proposed alignment of Twin Peaks Road in this area would interfere with historic drainage patterns. Water that currently flows south across El Camino de Mañana would be blocked by the proposed roadway; therefore, a channel is proposed to convey this blocked flow southwesterly along the north side of Twin Peaks Road (see Figure 3-19). These flows would be combined with the discharge from the proposed 2-cell 6-foot by 4-foot RCBC under Twin Peaks Road. The proposed channel will be lined, have a base width of 5 feet, and provide for a depth of flow between 1.91 and 2.65 feet. Flows from this channel would continue southwest to the new channel that would discharge into the cross drainage structure at approximate I-10 MP 244.81. Routing the flows in this manner would avoid two drainage structures under Twin Peaks Road.

**Table 3-3. Existing and Proposed Channels Serving I-10 and Frontage Roads**

<b>Outfall Location (approximate I-10 Milepost)</b>	<b>Existing Channel Bottom Width and Depth (approx.)</b>	<b>Proposed Channel Bottom Width and Flow Depth</b>
244.41	20 feet wide by 3.5 feet deep	70 feet wide by 3.38 feet deep
244.80	7 feet wide by 4 feet deep	30 feet wide by 2.74 feet deep
244.81	New – N/A	50 feet wide by 2.92 feet deep
245.18	6 feet wide by 3 feet deep	40 feet wide by 3.05 feet deep
245.19	3 feet wide by 3.5 feet deep	40 feet wide by 3.1 feet deep

### ***Proposed Santa Cruz River Channel Modifications***

Twin Peaks Road would approach the Santa Cruz River on both sides on embankment and then cross the Santa Cruz River on twin bridge structures of approximately 750 feet in length. The roadway and bridge embankments would place a large volume of fill within the Santa Cruz River floodplain. The fill would displace an equal volume of water and, if no additional action were taken, would change the 100-year floodplain elevation. To prevent any increase in flood water elevation, the low flow channel of the Santa Cruz River would be widened to offset the volume displaced by the roadway and bridge embankment. This topic will be discussed in greater detail in the Chapter 4, *Affected Environment* in the Section entitled *Floodplains* (see page 4-14).

The following chapter discusses the existing project area environment and anticipated effects to social, economic, and environmental resources within the project area from the construction of the preferred alternative. These effects are compared with the effects that would result from the no build alternative (doing nothing).